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(54) **Bearing assembly**

(57) A radial rolling bearing assembly for supporting a shaft in which the diameter (D_h) of the envelope circle or at least predetermined sections of the envelope circle of the radial bearing is smaller than the diameter (D_w) of the shaft, and the radial bearing has a member or members which is or are resilient in the radial direction. The members may be the outer race, the inner race, or the rolling elements.

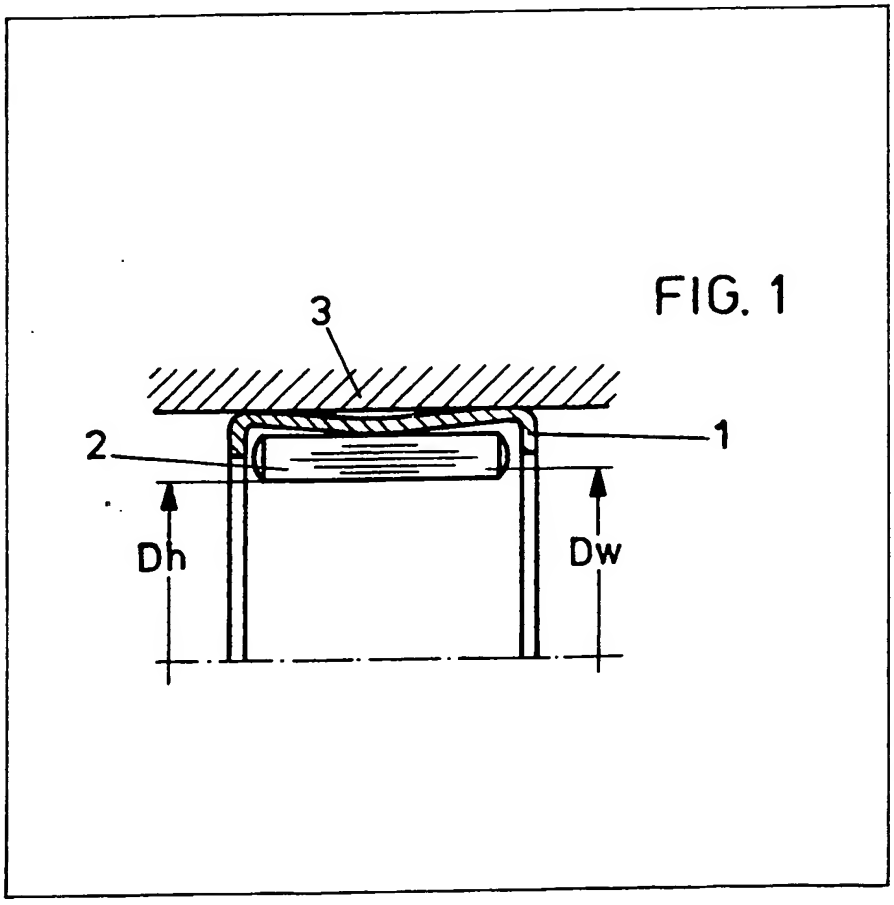

FIG. 1

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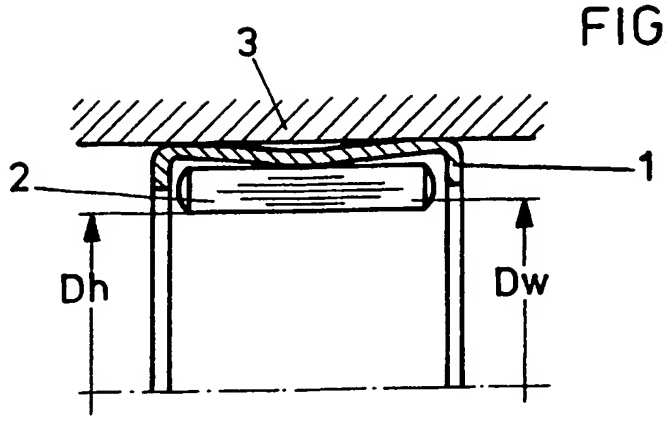


FIG. 2

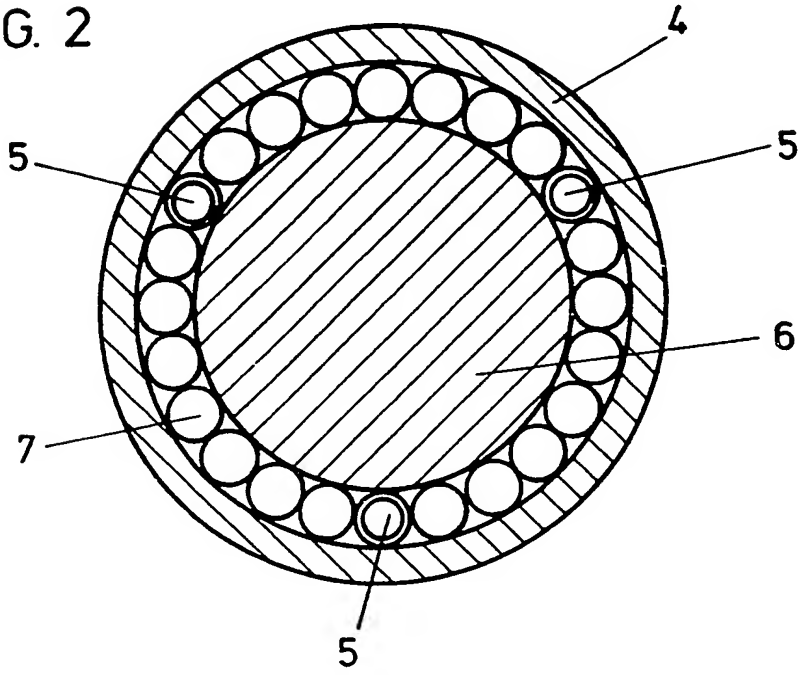
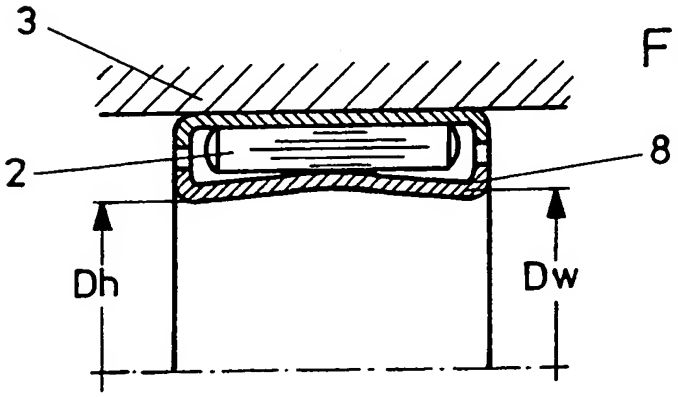


FIG. 3



SPECIFICATION

A radial bearing assembly

This invention relates to a radial bearing assembly for supporting a shaft, more particularly a motor vehicle steering shaft, which is mounted in a housing by way of a radial rolling-contact bearing.

Disturbing rattling noises sometimes occur when travelling in a motor vehicle over irregularities in the road. It has now been discovered that the cause of these rattling noises lies in the support means or bearings of the shafts, more particularly in the case of the steering shaft. Road shocks are transmitted through the wheels and the steering linkage to the steering shaft and there lead to the disturbing noises in the region of weaker cyclic loading or cyclic vibration in the bearings.

The invention aims as obviating the generation of these noises.

Accordingly, the present invention consists in a radial bearing assembly for supporting a shaft, which is mounted in a housing by way of a radial rolling-contact bearing, characterised in that the diameter of the envelope circle (D_h) or at least predetermined sections of the envelope circle of the radial bearing is smaller than the diameter (D_w) of the shaft and that the radial bearing has a member or members which is or are resilient in the radial direction.

It has been discovered that the occurance of the rattling noises under slight cyclic loadings or cyclic vibrations is attributable to the bearing play in the bearings. But a bearing play is always necessary for reasons of production. It can be over 15 μm. More particularly in the case of sheet-metal sleeve bearings, a bearing play of up to 80 μm is possible for a shaft diameter of approximately 35 mm.

According to the invention the bearing is pre-stressed that is to say the diameter of the envelope circle in the stage before installation (insertion of the shaft) is smaller than the shaft diameter. Upon installation the shaft is slid into the bearing under stress, which is permitted by the member or members which are resilient in the radial direction. The shaft is thus centred in service without play.

In addition to the application of the invention to motor vehicle steering shafts, other uses are also possible, for example in change-speed gears.

In one embodiment of the invention, the rolling-contact bearing includes an outer race which is constructed as a resilient member.

If a sheet-metal sleeve ring which is approximately 1 mm thick is used as rolling-contact bearing outer race, then it is advantageously provided that the outer race is a sheet-metal sleeve ring which has a waisted shape.

In this way a simple resilient action is obtained. After the assembly of the shaft the waisting is largely cancelled so that a pre-stressed shaft centering is obtained and the long-term strength of the resilient outer race is ensured. This construction of the bearing outer race is possible for bearings with and without a cage.

If a rolling-contact bearing which has an outer and an inner race is used, then it is provided as a further development of the invention that the inner race is of barrel-shaped construction.

Another advantageous embodiment of the invention provides that the rolling-contact bearing has resiliently deformable rolling-contact elements distributed over the circumference of the bearing, the diameter of the envelope circle (D_h) of said elements being smaller than the diameter (D_w) of the shaft.

According to the invention the rolling-contact elements themselves are used to eliminate the bearing play. The resiliently deformable rolling-contact elements, the diameter of the envelope circle of which is smaller that the shaft diameter, then ensure the pre-stressing in the installed state. In this case the resiliently deformable rolling-contact elements conveniently consist of plastics elements or thin-walled hollow steel elements.

In order that the invention may be more readily understood, reference is made to the accompanying drawings which illustrate diagrammatically and by way of example embodiments thereof, and in which:—

Fig. 1 shows a needle bearing with a sheet-metal sleeve ring as outer race,

Fig. 2 shows a rolling-contact bearing with resiliently deformable rolling-contact elements, and

Fig. 3 shows a needle bearing with an outer and inner race.

The bearing illustrated in Fig. 1 comprises an outer bearing race, which is constituted by a sheet-metal sleeve ring 1 and needles 2. The sheet-metal sleeve ring 1 is constricted in its median region, that is to say it has a waisted shape. In the uninstalled stage the envelope circle diameter D_h of the bearing is smaller than the diameter D_w of the shaft (not shown in Fig. 1) upon which it is proposed to mount the bearing. During assembly, i.e. upon insertion of the shaft, the sheet-metal sleeve ring 1 is expanded slightly, that is sufficiently for $D_h = D_w$, so that the bearing can be mounted. The sheet-metal sleeve ring 1 is then largely in contact with the housing part 3 without waisting and urges the needles 2 against the shaft without play.

In Fig. 2 an embodiment is shown where the rolling-contact bearing outer race 4 is too thick for it to be resiliently deformable. Instead of this, a plurality of rolling-contact elements 5 which are radially resiliently deformable and have a smaller envelope circle diameter D_h than the diameter D_w of the shaft 6 are distributed over the circumference of the bearing.

The rolling-contact elements 5 consist of plastics or of thin hollow steel elements. The resilient rolling-contact elements 5 arranged between the customary rolling-contact elements 7 have a slightly greater diameter than the rolling-contact elements 7, so that their envelope circle diameter is smaller and thus ensure the pre-stressing after the installation of the bearing. This construction is likewise possible with and without a cage.

According to Fig. 3 the invention can also be embodied with the use of a bearing inner race 8. In this case the bearing inner race 8 is of barrel-shaped construction. It may be with or without a flange. In

order to achieve a pre-stressed shaft centering of the bearing, the inside diameter D_h of the bearing race 8 in the uninstalled state is smaller than the shaft diameter D_w.

CLAIMS

1. A radial bearing assembly for supporting a shaft which is mounted in a housing by way of a radial rolling-contact bearing, characterised in that the diameter of the envelope circle (D_h) or at least predetermined sections of the envelope circle of the radial bearing is smaller than the diameter (D_w) of the shaft and that the radial bearing has a member or members which is or are resilient in the radial direction.

2. A bearing assembly according to claim 1, wherein the rolling-contact bearing includes an outer race which is constructed as a resilient member.

3. A bearing assembly according to claim 2, wherein the outer race is a sheet-metal sleeve ring which has a waisted shape.

4. A bearing assembly according to claim 1, wherein the rolling-contact bearing includes an outer and an inner race, the inner race being of barrel-shaped construction.

5. A bearing assembly according to claim 1, wherein the rolling-contact bearing is provided with resiliently deformable rolling-contact elements distributed over the circumference of the bearing, the diameter of the envelope circle (D_h) of said elements being smaller than the diameter (D_w) of the shaft.

6. A bearing assembly according to claim 5, wherein the resiliently deformable rolling-contact elements consist of plastics elements or of thin-walled hollow steel elements.

7. A radial bearing assembly for supporting a shaft, substantially as herein described with reference to and as shown in any one of Figs. 1 to 3 of the accompanying drawings.

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